黑龙江中新世的鲴亚科(鲤科)化石及新生代晚期东亚淡水鱼类区系的演替[1)]

张弥曼[1]　陈宜瑜[2]　同号文[1]

1 中国科学院古脊椎动物与古人类研究所　北京　100044

2 中国科学院水生生物研究所　武汉　844000

摘要　本文记述了鲴亚科的一个化石新属新种 *Eoxenocypris liui*，标本产于黑龙江省桦南县附近的中新世地层中。它与现生鲴亚科鱼类的区别是：头长大于体高，口端位，鳃盖长大于高，背鳍起点至吻端距较其至尾鳍基距为大，臀鳍起点至腹鳍起点的距离小于其至尾鳍基的距离。对新生代晚期东亚淡水鱼类特征分析的结果表明，从中新世到上新世东亚大陆和日本列岛存在一个相同的淡水鱼类区系。这一区系在中国东部一直延续到现在，而在日本自更新世中期以后却发生过较大的演替。

关键词　黑龙江，中新世，鲴亚科，鱼类区系

一、前　　言

鲴亚科鱼类是我国东部广布的鲤科鱼类，它们主要生活在北起黑龙江南到珠江的平原地区，栖息在江河、湖泊等较宽阔的水域中，海南和台湾也有它们的踪迹，有少数种类出现在西南部的云南、四川等地（杨干荣，1964；李思忠，1981）(图 1)。在我国的邻近国家中，仅见于越南河内盆地红河流域。与我国相连的朝鲜半岛和隔海相望的日本却没有它们的记录（Tomoda，1979）。

我国已知的鲴亚科鱼类化石地点全都座落在现生鲴亚科鱼类的分布范围内（图 1，表 1)。完整的化石发现在山西榆社盆地上新世早期高庄组中，是现生鲴属（*Xenocypris*）的一个化石种——榆社鲴（*X. yüshensis*）(刘宪亭、苏德造，1962)，在这一地区中新世晚期马会组采集的为筛选小哺乳动物牙齿化石的砂样中也曾见到鲴类咽齿化石（据周家健告知)。山东济阳坳陷中新世馆陶组及上新世明化镇组（张弥曼等，1985；李玲俐等，1992)，江苏泗洪县、淮阴县早中新世晚期下草湾组、丰县中新世到上新世、淮安县上新世地层中都曾发现大量鲴类的咽齿（张弥曼等，1985)。此外，内蒙通古尔中中新世晚期地层中也发现了鲴类的咽齿（据周家健告知)。可见鲴亚科鱼类化石不仅在上新世而且中新世在中国东部分布都是很广的。

1) 本课题由国家自然科学基金资助，项目号：49272076。

收稿日期：1995－06－12

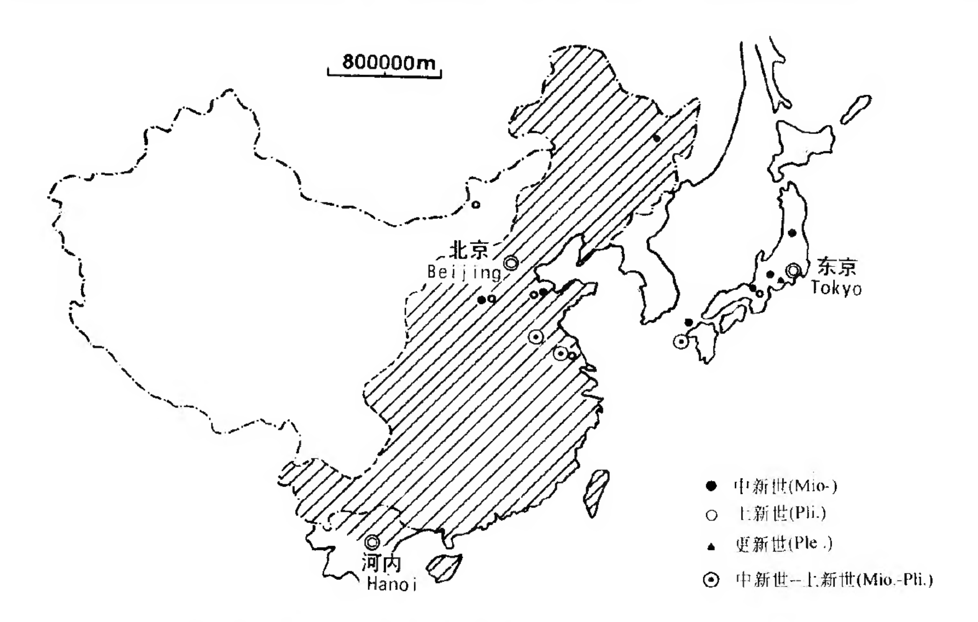


图1 东亚地区鲴类化石产地分布图（日本资料据Tomoda等，1977；Yasuno 1986)；斜线部分代表现生鲴类的分布域

Fig.1 Map of localities of fossil xenocyprinines in East Asia; dashed parts indicate the distributions of living xenocyprinins

中国之外的地区，鲴类化石迄今只在日本发现过，分布亦甚广（图1，表1)。

本文描述的鲴类化石，最早的少数标本（1991年）是由地矿部沈阳地质矿产研究所苏养正和黑龙江省地质三大队倪春林提供，采自桦南县东北四方台村以北二公里砂金

表1 已报道的鲴类化石地点及层位

Table 1 Known localities and horizons of fossil xenocyprinins

地区 region	地点 locality	层位 horizon	化石材料 fossil material	报道者 authors
山西省 Shanxi Province	榆社盆地武乡 Yushe Basin, Wuxiang	上新世早期高庄组 Gaozhuang Fm. (E. Pli.)	*Xenocypris yushensis* Liu et Su	刘宪亭，苏德造 (1962)
		中新世晚期马会组 Mahui Fm. (L. Mio.)	Xenocyprininae gen. et sp. indet.	据周家健
山东省 Shandong Province	济阳坳陷 Jiyang Basin	上新世明化镇组 Minghuazhen Fm. (Pli.) 中新世馆陶组 Guantao Fm. (Mio.)	Xenocyprininae gen. et sp. indet.	张弥曼等(1985) 李玲俐等(1992)

续表1

地 区 region	地 点 locality	层 位 horizon	化石材料 fossil material	报道者 authors
江苏省 Jiangsu Province	泗洪、淮阴县 Sihong and Huaiyin	中新世晚期下草湾组 Xiacaowan Fm. (L. Mio.)	Xenocyprininae gen. et sp. indet.	张弥曼等 (1985)
	丰县 Fengxian	中新世–上新世 (Mio.–Pli.)	Xenocyprininae gen. et sp. indet.	
	淮安县 Huaian	上新世 (Pli.)	Xenocyprininae gen. et sp. indet.	
内蒙古 Nei Mengol	通古尔 Tunggur	中中新世晚期 通古尔组 Tunggur Fm. (M. Mio.)	Xenocyprininae gen. et sp. indet.	据周家健
黑龙江省 Heilong-jiang Province	桦南县 Huanan	中新世中晚期 道台桥组 Daotaiqiao Fm. (M. –L. Mio.)	*Eoxenocypris liu* gen. et sp. nov.	本文
日本国 Japan	岐阜县谣坂 可倪盆地 Gifu	早中新世瑞浪群 Mizunami Gr. (E. Mio. 中村组 Nakamura Fm.	*Xenocypris* sp. ? *Distoechodon* sp.	杉之原，上野 (1967) Tomoda 等 (1977)
		帷子组 Katabira Fm. 蜂屋组 Hachiya Fm.	Xenocyprininae gen. et sp. indet.	Yasuno (1986) Kodera and Nomura (1988)
	京都丹后半岛 宫津市木子 Kyoto	中新世早期鄄冈组 Seya Fm. (E. Mio.)	Xenocyprininae gen. et sp. indet.	Tomoda 等 (1977) Yasuno (1986)
	九州西北对马海 峡中的壹歧岛 Iki Island Nagasaki	早中新世晚期 长者原硅藻土组 Chojabaru Fm. (E. Mio.)	*Xenocypris* cf. *X. yushensis* ? *Xenocypris* sp.	Ishida 等 (1970) Tomoda 等 (1977)

续表 1

地 区 region	地 点 locality	层 位 horizon	化石材料 fossil material	报道者 authors
日本国 Japan	山形县西田川郡 温海町 Yamagata	中中新世关川组 Sekikawa Fm. (M. Mio.)	*Xenocypris* sp.	Tomoda 等 (1977) Yasuno 等 (1986)
	长崎县平户岛 女鹿崎 Hirato Island Nakasaki	晚中新世－早上新世 平户组 Hirato Fm. (L. Mio.－E. Pli.)	? *Xenocypris* cf. *X. yüshensis*	Tomoda 等 (1977) Tomoda (1979)
	三重县大山田村 琵琶湖东南岸 Mie	上新世 伊贺组 Iga Fm. (Pli.)	Xenocyprininae gen. et sp. indet.	Nakajima (1986)
	静冈县引佐町谷下 Shizuoka	中更新世 相当佐浜泥组 (M. Plei.)	*Distoechodon* cf. *D. tumirostris* 下咽骨及咽齿	Uyeno (1965) Tomoda (1979)

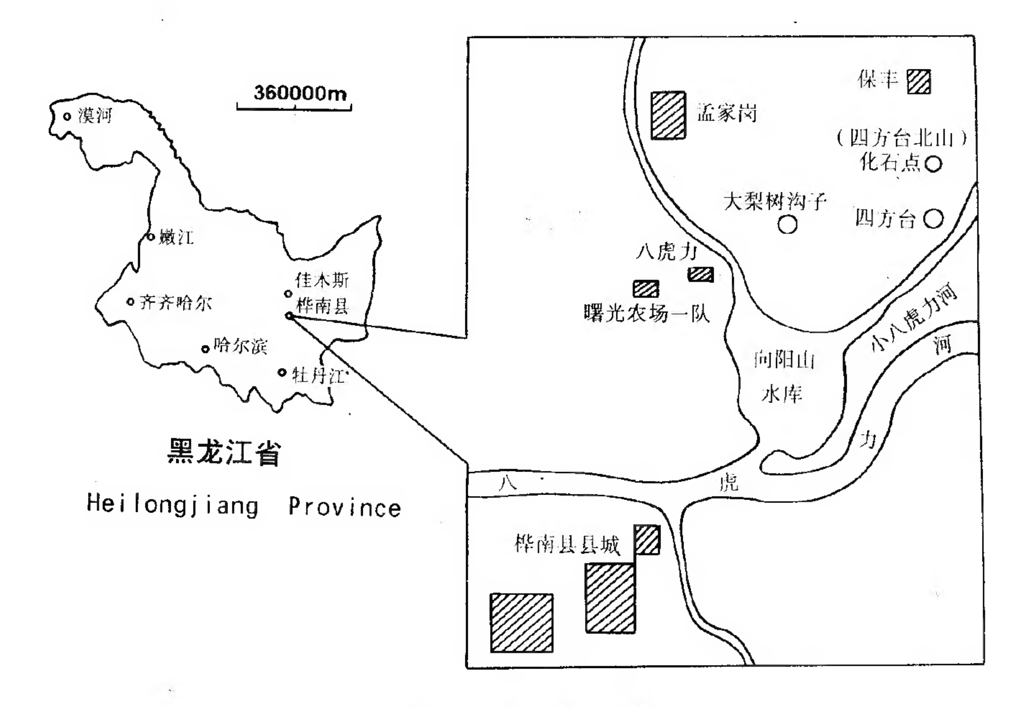


图 2 黑龙江省鲴类化石产地位置图

Fig.2 Map of locality of *Eoxenocypris liui* gen. et sp. nov.

矿第6井（图2）。次年，古脊椎所同号文、张宏专程到该化石地点进行实地考察，在第2、3、4井中采集了大量鱼类及植物化石，二者均产于中新世"道台桥组"（黑龙江省区域地层表编写组，1979）黄绿色粘土层，偶有采于灰白色粘土中。其下的含金砂砾层中产轭齿象 *Zygolophodon* sp.（齐陶，1992）。植物化石经南京地质古生物研究所李浩敏鉴定，至少有14科20属30余种，其中以桦木科（Betulaceae）和壳斗科（Fagaceae）为主，她认为根据植物组合，化石产出层位的时代可能是中新世中晚期。

桦南县的这批化石是除榆社之外保存最完整、而时代要比榆社早的鲴类化石。和榆社不同的是，这一地点的鱼类区系结构单一，采到的数十个鱼化石标本以及大量由于太破碎而没有采集的材料几乎都是鲴类。鱼体因埋藏时挤压而产生的变形不大，由于石化程度不高，围岩不够坚实，标本均采用机械方法修理。保留的白色骨片比较疏松破碎，在大多数情况下只能根据印痕来辨别骨片的形状。由于构成咽齿的珐琅质比较坚固，在许多标本上都保存了完整或不完整的咽齿，有时咽齿尽管破碎，却仍整排地与下咽骨连接在一起，成为鉴定鲴类的最可靠依据。

文中所引有关地层时代的意见据邱占祥（Qiu，Z－X，1990）及邱占祥、邱铸鼎（1990）。

二、标 本 描 述

骨鳔超目　Superorder Ostariophysi

鲤形目　Order Cypriniformes

鲤亚目　Suborder Cyprinoidei

鲤科　Family Cyprinidae

鲴亚科　Subfamily Xenocyprininae

始鲴属（新属）*Eoxenocypris* gen. nov.

属征　体型较小的鲴亚科鱼类，口端位，吻钝，口裂斜，头长大于体高，鳃盖长大于高，背鳍起点至吻端距较其至尾鳍基距为大，臀鳍起点至腹鳍起点距离较其至尾鳍基距离为近。

属型种　*E. liui*，仅有种。

释名　*Eo*－，希腊文，早期的；*Xenocypris*，鲴亚科的科型属，种名 *liui* 赠予为我国鱼化石研究作出巨大贡献的刘宪亭先生。

刘氏始鲴（新属、新种）*Eoxenocypris liui* gen. et sp. nov.

（图版 I，II；图3，4）

种征　同属征。

正型标本　一条近于完整的鱼，仅尾鳍后部缺失，体长85.2mm。古脊椎动物与古人类研究所标本编号 V12064.1。

其它材料　计有近于完整的鱼体8尾（V12064.2－5，7，8，15），保存了部分鱼体或重要零散骨片的标本20余枚（V12064.6，9－33）。

产地及层位 黑龙江省桦南县城东北四方台村北二公里砂金矿，中新世“道台桥组”。

描述 一种小型鱼类，已采得标本体长约在50至120mm之间，较一般现生鲴亚科鱼类为小（现生鲴类的成体体长通常为70－280mm，杨干荣，1964）。体狭长，侧扁，最大体高位于背鳍起点处或稍前。头长明显大于体高（图版I，1－3；图版II，2），体长为头长的3－3.4倍，为体高的3.7－4.5倍（V12064.1，V12064.2，V12064.8），为尾柄长的5.7－6.2倍，尾柄高的9.0－11倍。体高为尾柄高的2.0－2.2倍。口端位（图版I，1－2）。吻短而钝，吻长略大于眶径，头长为吻长的3.7－4.0倍，为眶径的3.8－4.2倍。眶后距远大于吻长，在保存较完整的标本中分别为吻长的1.8和2.1倍（V12064.8，V12064.1）。头长为尾柄长的1.8－2.1倍，尾柄高的2.6－3.1倍。以上身体各部分的比例，除头长显著大于体高外，均在现生鲴亚科各属种以及榆社鲴的变异范围之内。

表2 刘氏始鲴化石测量数据（单位：毫米）

Table 2 Measurements of *Eoxenocypris liui* gen. et sp. nov. (in mm)

标本号	体 长	体 高	头 长	头 高	眼 径	眶前距	眶后距
V12064.1	85.2	20.2	28.2	20.3	6.7	6.9	14.6
V12064.2	80.9	17.7	25.3	18.6	6.7	6.8	11.8
V12064.3	约89	?	约30	?	8.0	约8	14
V12064.5	69.4	16.7	约19	15.6	?	?	9.6
V12064.8	52.2	12	16.2	12.1	4.1	4.1	8.2
V12064.15	65.3	17.4	22	18.0	?	?	?

标本号	尾柄长	尾柄高	背鳍条	背鳍刺长	臀鳍条	躯 椎	尾 椎
V12064.1	13.7	9.4	II，7	15.5	iii，12	>18	19
V12064.2	14.2	8.0	II，7	16.1	iii，>11	>18	19
V12064.3	14.9	?	II，7	16.2	?	>19	19
V12064.5	11.7	6	II，7	12.5	?	>19	19
V12064.8	9.5	5.4	>I，7	9.8	iii，>11	?	>18
V12064.15	10.5	7.0	III，7	12.4	iii，12	>19	19

头部骨骼中鳃盖系统保存较好，鳃盖骨为一不等边四边形，前缘及下缘长，形成向前方突伸的前下角，使鳃盖骨长大于高，后下缘浑圆（图版I，5；图版II，1，图3）。前鳃盖骨外缘相交近直角，背、腹枝约等长。下鳃盖骨和间鳃盖骨都和其它鲤科鱼类相同。下颌骨（齿骨＋隅关节骨）短，十分倾斜，与方骨关节处很靠前，约在眼眶前缘下方，因此口裂很小（图版I，1－2）。

在许多标本上都保存了咽齿，虽均较破碎，但仍能辨别它们的形状。所见齿均较大，十分侧扁，侧面宽阔、光滑，咀嚼面窄条状，上端尖，但不成钩状，与鲴亚科鱼

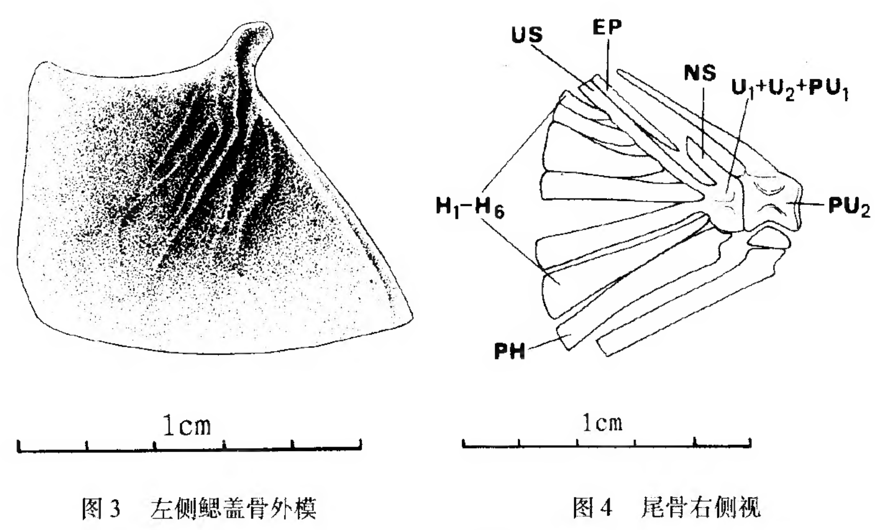


图 3 左侧鳃盖骨外模
Fig.3 Left operculum, outer impression

图 4 尾骨右侧视
Fig.4 Caudal skeleton, right view

类主行咽齿非常相似。V12064.16 号标本 (图版 II, 5) 保存了下咽骨及在原位的一排约 6 个咽齿, 下咽骨较短宽, V12064.18 号标本上的下咽骨虽然很不完整, 但与它相连的一排咽齿却仍在原位, 数目大约也是 6 个 (图版 II, 4)。这 6 个一排的咽齿看来应该是主行咽齿, 在任何标本上都没有看到其它类型或在其它位置上的咽齿, 但由于标本十分破碎, 目前还不能断言是否不存在第二或第三行咽齿。从主行咽齿的数量、形状等特点来看, 无疑是鲴亚科类型的咽齿。从它们的形状和长度来说, 似与 *Distoechodon* 和 *Pseudobrama* (= *Acanthobrama*) 更接近 (Chu, 1935)。

肩带中仅能观察到的完整骨片为匙骨 (图版 II, 4), 形状与一般鲤科鱼类中所见无二。

背鳍起点与腹鳍起点相对, 稍前或稍后, 至吻端的距离较其至尾鳍基的距离为大。胸鳍不达腹鳍。腹鳍起点恰位于胸鳍起点至臀鳍起点间距离的中点。臀鳍起点距腹鳍起点较距尾鳍基为近。在少数标本中背鳍条为 iii, 7, 而在大多数标本中能够观察到的只有 ii, 7, 这可能是因为第一根不分叉鳍条很短小, 常常不容易保存而未被发现的缘故。最后一根不分叉鳍条为粗壮的光滑硬刺 (图版 I, 2 –4), 后缘无锯齿, 头长为硬刺长度的 1.6 –1.8 倍。背鳍支持骨 11 枚。臀鳍条 iii, 12, 支持骨 13 枚。胸鳍条 i, 15。腹鳍条 i, 8。尾鳍叉形, 长鳍条 i, 9 –8, i。在现生鲴类中除背鳍起点距吻端较距尾鳍基为近, 臀鳍起点距腹鳍起点较距尾鳍基为近外, 各鳍相对位置及鳍条数, 特别是背鳍第三根鳍条为粗壮的光滑硬刺, 与本文所描述的新属种的情况都很相似。

尾椎 (caudal centra) 保存完整, 共 19 个。由于最前几个躯椎 (abdominal centra) 通常保存很差, 只能数出大约 19 个保存较好的躯椎, 估计最前面保存较差的躯椎约有 3 –4 个, 脊椎的总数应该在 41 –42 个左右, 也在现生鲴亚科鱼类的变异范围之内。尾骨结构与大部分鲤科鱼类中的情况相似 (图版 II, 3; 图 4), 第一尾前椎 (PU_1, preural 1) 和第一、二末端尾椎 (U_1, U_2, ural centrum 1 and 2) 愈合, 与此复合椎

体愈合的尾杆骨（US, urostyl）向后上方延伸，尾下骨六枚（H_{1-6}），与尾鳍下叶鳍条连接的第一尾下骨（H_1, hypural I）近端与复合尾椎愈合，第二尾下骨（H_2）和副尾下骨（PH, parhypural）近端与复合尾椎连接，第三至六尾下骨（H_3-H_6）近端与尾杆骨腹缘相连，复合尾椎背面尾杆骨前方有一个短的、不完全的神经棘（NS），尾杆骨背侧有一个细长的尾上骨（EP, epural），未见膜质尾骨（urodermal）。

鳞片未保存。

三、讨 论

1. 比较

新属种 *Eoxenocypris liui* 和鲴亚科鱼类有许多相同的特征，如咽齿较大，侧扁，侧面宽大，平滑，咀嚼面狭长，上端尖但不呈钩状，主列咽齿6枚；背鳍条iii，7，第三根不分叉鳍条为粗壮的光滑硬刺，后缘无锯齿，臀鳍条iii，12，胸鳍条i，15，腹鳍条i，8；背鳍与腹鳍大致相对，胸鳍不达腹鳍，腹鳍起点在胸鳍起点至臀鳍起点间距离的中点，归入鲴亚科应该是没有问题的。但它和鲴亚科的多数成员包括榆社鲴之间存在几个显著的差别：个体相对较小，头长显著大于体高；吻钝，口裂小，口端位；背鳍起点至吻端距较其至尾鳍基距为大，臀鳍起点至腹鳍起点的距离较至尾鳍基距离为近。根据刘氏始鲴的特有特征，我们认为难以将其归入任何现生属中，只能确立一个新属。虽然日本的鲴类化石材料大多为咽齿，但也不乏完整或比较完整的鱼体，如壹岐岛、平户岛、丹后半岛、山形县、岐阜县等地的中新世地层中都有较好的材料。其中的一些，据研究者的意见，和现生鲴类可能有属级的差异，但是并没有建立新的类元（Tomoda，1979）。从他们的描述中看起来，这些化石和刘氏始鲴具有一些相同的特点，例如壹岐岛被鉴定为榆社鲴相似种（*Xenocypris* cf. *yüshensis*）的标本，具有端位而不是下位的口（Tomoda等，1977），岐阜县的材料中也有类似的情况（Kodera和Nomura，1988）。因为缺少更详细的资料，对于刘氏始鲴和日本中新世鲴类的关系还无法作出更加肯定的结论。

陈宜瑜（1982）所建立的产于广西钦州的鲴亚科的一个现生新属种小似鲴（*Xenocyprioides parvulus*），以及后来他和黄宏金描述的产于广西龙州的同一个属的另一个新种棱似鲴（*X. carinatus*，罗云林等，1985），和鲴亚科其它种类有许多不同的地方。虽然其亚上位的口，和刘氏始鲴相似，但它们个体很小，体长仅21－30mm，背鳍无硬刺，脊椎数目较少（33－35），又和刘氏始鲴以及所有现生鲴类都不同。它们的体侧纵列鳞（31－33）远少于现生鲴类，而且没有侧线，与现生鲴类各种差别较大．陈宜瑜指出，小似鲴的外形与细鲫属（*Aphyocypris*）有几分相似，但齿型却近似鲴属（*Xenocypris*）。因此似鲴属的置于鲴亚科主要是根据咽齿的结构。看来似鲴属的确立，或将拓宽鲴亚科的范围，或者，似鲴属的分类位置连同有关亚科的划分，还值得重新考虑。

2. 东亚新生代晚期淡水鱼类区系及鲴亚科鱼类的时空分布

迄今已知中国境内的新生代晚期鱼化石地点主要的有两个，山东临朐山旺早中新世

晚期山旺组硅藻土层和山西榆社中新世晚期马会组及上新世早期高庄组泥岩（图 1，表 1）。

山东临朐山旺的化石曾由杨钟健、张春霖（Young 和 Tchang，1936）研究并鉴定为几个现生属的化石种（*Barbus linchuensis*，*Barbus scotti*，*Pseudorasbora macrocephala*，*Leuciscus miocenicus*）。这一地点的化石最近经周家健（1990）重新采集和研究，她和前人一致的意见是，这一鱼群主要由现代这一地区十分繁盛的鲤科鱼类组成。但她的研究结果表明，现有标本中除鮈亚科的颌须鮈 *Gnathopogon* 外，并无其它可归入现生属的种类，而是一些新的化石属，可分别归入鲤亚科（Cyprininae：鲁鲤 *Lucyprinus*、扁鲤 *Platycyprinus*、齐鲤 *Qicyprinus*）、雅罗鱼亚科（Leuciscinae：似雅罗鱼 *Plesioleuciscus*）以及担尼鱼亚科（Danioninae：弥河鱼 *Miheichthys*）。需要指出的是，在山旺发现和采集的众多标本中尚未发现鲴类化石，不过，时代略早于山旺组的江苏泗洪下草湾组中已发现过鲴类咽齿化石。山旺的鱼群，除未发现鲴亚科鱼类外，和日本本州、北海道日本海沿岸中新世早期的一些化石地点（如京都、福井、岐阜、石川、山形、北海道南部等地）所产的鱼群非常相似（Tomoda 等，1977；Yasuno，1986），其中有些种类甚至被定为相同的属，如 *Lucyprinus* 在山旺、福井、岐阜、石川、北海道等地都有发现（周家健，1990；Yasuno，1986）。因此，中国东部和日本中新世早期的鱼群看来应属同一个鱼类区系。这个区系和当今东亚的淡水鱼类区系很不相同，它的绝大部分种类均非现生属，更没有现生种。它的组成以鲤科鱼类为主，其中又以鲤亚科、雅罗鱼亚科鱼类占主导地位，虽然日本的鱼群中鲴类也是很重要的成分。日本学者曾多次指出，日本早中新世的淡水鱼类区系和东亚大陆的现生鱼类区系相近，但和日本现生鱼类区系不同（Tomoda，1976 等）。值得提到的是，一些研究哺乳动物的中国和日本学者新近也陆续发现，中、日两地中新世地层共有一些相同属种的哺乳动物，如同时产于山东山旺组、江苏泗洪下草湾组及长崎佐世保盆地野岛群（Nojima Group）Fukazaki 组（Fukazuki Formation）的山东硅藻鼠（*Diatomys shantungensis*）（Kato 和 Otsuka，1995），以及同时产于下草湾组及岐阜瑞浪盆地 Toki 褐煤层（Toki Lignite Formation，与可儿盆地中村组相当）的中国杨氏河狸（*Youngofiber sinensis*）（Tomida and Setoguchi，1994），邱占祥等（1991）也曾发现，山旺组和可儿盆地平牧组（Hiramaki Formation）共有矢木氏近貘（*Plesiotapirus yagii*）。以上作者根据早中新世晚期两地相同的哺乳动物化石，都作出了当时两地在动物地理方面关系较近的结论。这和我们根据鱼类化石得出的结论是很一致的。

山西的标本曾由刘宪亭、苏德造（1962）研究，鱼群中的鲤科鱼类都可以归入现生属或甚至现生种，如 *Cyprinus carpio*，*Carassius auratus*，*Mylopharyngodon piceus*，*Ctenopharyngodon idellus* 等，其中只有不到半数被定为新的化石种。除鲤科鱼类外，这一鱼群还包括鲶形目（Siluriformes）鲶科（Siluridae）的 *Parasilurus asotus*（现生种），鲈形目（Perciformes）鮨科（Serranidae）的 *Siniperca wusiangensis*（化石种）和鳢形目（Ophiocephaliformes）鳢科（Ophiocephalidae）的 *Ophiocephalus argus*（现生种）。这一鱼群中鲤科鱼类的组成和日本琵琶湖地区同时期伊贺组大山田粘土层的鱼群在亚科的水平上十分一致，包括鲤亚科（Cyprininae）、鲴亚科（Xenocyprininae）、鲌亚科（Cultrinae）、鮈亚科（Gobioninae）、雅罗鱼亚科（Leuciscinae）等（刘宪亭、苏德

造，1962；Nakajima，1986）。日本的材料虽然丰富，但多为咽齿、鳞片及零散骨片，很难与山西的种类作进一步的比较。除鲤科鱼类外，日本的鱼群中也发现了鲶科的*Parasilurus*以及同一目的鮠科（Bagridae）鱼类的残余（Tomoda，1991）。研究古琵琶湖鱼类化石的日本学者多将这一鱼群与榆社的鱼群对比（Tomoda，1978，1982，1984，1991；Nakajima，1986）。这两个组成十分相似的鱼群表明，中国大陆东部和日本在上新世也属于同一个淡水鱼类区系。这个区系的鲤科鱼类包含了现生鲤科鱼类的若干亚科，它的组成中已几乎全为现生属，且半数以上是现生种。除鲤科鱼类外，还有鲶形目、鲈形目和鳢形目的鱼类。总的看来，上新世鱼类区系的组成已和中国大陆东部现今的淡水鱼类区系很相近，可见亚洲东部淡水鱼类区系自上新世早期已初步确立，并一直繁衍发展至今。

值得特别提出讨论的是对马海峡中的壹岐岛早中新世晚期长者原硅藻土所产的鱼群，其中除有许多完整的鲴类被鉴定为榆社鲴相似种（*Xenocypris* cf. *yüshensis*）外，还有一些鉴定为现生属、种的鲤科鱼类，如*Cyprinus carpio*，*Achelognathus*，*Ancherythroculter*，*Hemiculter*，甚至还有鳜鱼*Siniperca*（Ishida等，1970；Tomoda等，1973，1977；Geological Research Group of Iki Islands，1973；Hayashi，1975），它与日本其它同时期地点的鱼化石组成大不相同，而与榆社的上新世鱼群却有几分相似。这一事实已由安野胜敏（Yasuno，1986）指出。对长者原硅藻土的时代过去曾有过争论（Ishida等，1970），其中的鱼化石尚需进一步研究，待两方面的工作有了定论，才能探讨壹岐岛鱼群的性质和归属问题。

从化石资料看，鲴类是中新世在日本淡水鱼群中占主导地位的鱼类之一，它们大多被发现在现今日本海沿岸的湖相沉积中。它们在日本一直生存到更新世中期，但在现生淡水鱼类区系中却已消失。一些日本鱼类学家（Tomoda，1977；Nakajima，1986）根据这一情况，并根据当时中国大陆仅知的鲴类化石产自上新世地层的事实，得出结论说，鲴类是中新世早期在亚洲大陆边缘（即日本列岛现今所在地）起源，中新世中、晚期自大陆边缘向内陆扩散，从此在大陆繁衍生息，而在日本却步向绝灭。但是上文提到的许多中国大陆的中新世鲴类化石（张弥曼等，1985；李玲俐等，1992及周家健告知）以及本文描述的也属于中新世的*Eoxenocypris liui*都表明，中新世鲴类在中国大陆也是相当繁盛的。这说明中国东部和日本列岛晚新生代应属同一个鱼类区系。关于更新世中期以后鲴类在日本的绝灭原因，日本学者已作了许多探讨，至今尚无定论。但显然是日本列岛与东亚大陆阻隔后，环境变迁和区系分衍的结果。

四、结　　论

1. 黑龙江省桦南县中新世道台桥组所产的*Eoxenocypris liui*是鲴亚科的一个和现生属、种不同的化石新属新种。

2. 中新世时鲴类在中国大陆即已相当繁盛，并非如日本学者过去所推测，在中新世中晚期由大陆边缘，即现今日本列岛，扩散到内陆。

3. 根据中国东部及日本晚新生代包括鲴类在内的淡水鱼类化石的研究，中国东部

和日本列岛中新世和上新世很可能都属于同一鱼类区系。这一鱼类区系在中国大陆一直延续到现代，而在日本列岛从更新世中期以后则发生较大的演替。

4. 东亚地区中新世的鱼类区系虽以这一地区现今大量繁盛的鲤科鱼类为主，但和现代鱼类区系不同的是，绝大多数都是化石属种。上新世的鱼类区系中现生属种才占了优势，并一直繁衍发展至今。

致谢 承地矿部沈阳地质矿产研究所苏养正及黑龙江省地质三大队倪春林提供产地线索，日本东京国立科学博物馆上野辉弥协助提供参考文献，古脊椎所周明镇阅读文稿，工作过程中与周家健、吴文裕、邱铸鼎多次讨论地层和化石方面的问题，南京地质古生物研究所李浩敏鉴定植物化石并提供地层时代的意见，水生生物研究所刘焕章特意剥制现生鲴类标本并对本项工作提出宝贵意见，古脊椎所张宏参加化石采集，张杰摄制图版，杨明婉绘制插图，笔者特在此致谢。

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A NEW MIOCENE XENOCYPRININE (CYPRINIDAE) FROM HEILONGJIANG PROVINCE, NORTHEAST CHINA AND SUCCESSION OF LATE CENOZOIC FISH FAUNAS OF EAST ASIA

Chang Mee-mann[1] Chen Yiyu[2] Tong Haowen[1]

1 *Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences* Beijing 100044

2 *Institute of Hydrobiology, Chinese Academy of Sciences* Wuhan 844000

Key words Heilongjiang, Miocene, xenocyprinines, new taxon, fish faunas

Summary

A new genus and species of Xenocyprininae (*Eoxenocypris liui*) is described from

a placer gold mine northwest of Hua'nan County, Heilongjiang Province. The distribution of the extant members of the subfamily is limited to the eastern lowlands of China and Hanoi Basin (Song Hong Valley), northern Vietnam. In Late Cenozoic, however, in addition to their recent area of habitat they were also widely spread in Japan, mainly in the lacustrine deposits in the western side of the island arch along the Sea of Japan.

Description

Superorder Ostariophysi

Order Cypriniformes

Suborder Cyprinoidei

Family Cyprinidae

Subfamily Xenocyprininae

***Eoxenocypris* gen. nov.**

Diagnosis Xenocyprinin of relatively small size, mouth terminal, gap oblique, length of head exceeding depth of body, opercular longer than deep, origin of dorsal fin closer to caudal fin base than to tip of snout, origin of anal fin closer to insertion of pelvic fin than to base of caudal fin.

Type species *E. liui*, only species.

Etymology *Eo*-, Greek, early; *Xenocypris*, type genus of the subfamily Xenocyprininae; species name *liui* is dedicated to Prof. Liu Hsian-ting who had contributed much to the work on the Chinese fossil fishes.

***Eoxenocypris liui* sp. nov.**

(Pl.I, II; Figs.4, 5)

Diagnosis As for the genus.

Holotype A nearly complete fish with the posterior portion of its caudal fin missing, IVPP V12064.1.

Other material Eight nearly complete fish (V12064.2-8, 15); 21 specimens of parts of fish and disarticulated bones (V12064.9-14, 16-30).

Locality and horizon The placer gold mine 2 km north to the village of Sifangtai, northeast of Hua'nan city, Helongjiang Province; "Daotaiqiao Formation"; Middle or Late Miocene.

Description The standard length of the few nearly complete specimens is between 50 to 120 mm, smaller than that of the extant xenocyprinines (between 70 to 280 mm). The maximum depth of the body is situated at the origin of the dorsal fin or somewhat anterior to it. The length of the head is larger than the body depth. The

standard length is 3–3.4 times of the head length, 3.7–4.5 times of the body depth, 5.7–6.2 times of the length of the peduncle and 9–11 times of the depth of the peduncle. The depth of the body is 2–2.2 times of the depth of the peduncle. The mouth has a terminal position. The snout is short and blunt. The length of the snout is a bit longer than the orbit diameter. The length of the head is 3.7–4 times of the snout length and 3.8–4.2 times of the orbit diameter. The length of the head is 1.8–2.1 times of the length of the peduncle and 2.6–3.1 times of the depth of the peduncle. The proportions of the body, except that the head length is much larger than the body depth, all fall in the ranges of the extant xenocyprinines and the fossil *X. yüshensis*.

In the skull the opercular series is among the better preserved bones. The antero–ventral corner of the opercular protrudes forward thus making the bone longer than deep. The two arms of the preopercular are of the same length and the angle between them is nearly 90°. The lower jaw is rather short and its articulation with the quadrate is rather anteriorly placed, under the anterior border of the orbit.

Pharyngeal teeth are seen on many specimens. Though crashed their shape is still discernable. They are of comparatively large size, laterally compressed with extensive lateral surface. The grinding surface is narrow and long and tapers to a point but not recurved tip. On a few specimens the pharyngeal bones are preserved with the teeth in situ. Six teeth can be counted from the main row though we are not sure if the second and third rows of teeth are absent. Judging from the shape of the teeth they remind of those of *Distoechodon* and *Acanthobrama*.

The origin of the dorsal fin is approximately opposite to that of the pelvic. It is closer to the base of the caudal fin than to the snout tip. The pectoral fin does not reach the pelvic, the origin of which is situated at the midpoint of the distance between the pectoral and anal. The origin of the anal fin is located closer to the insertion of the pelvic than to the base of the caudal fin. The rays in the dorsal fin are iii, 7. The last unbranched ray is rather stout and smooth, without serration. The head length is 1.6–1.8 times of the ray. The rays in the anal fin are iii, 12. Those of the pectoral fin are i, 15 and of pelvic fin–i, 8. The caudal fin is forked with i, 9–8, i long rays. Besides the relative position of the dorsal fin to the snout tip and the caudal fin base, and that of the anal fin to the insertion of the pelvic the caudal fin base, other relative position of the fins and the numbers of the rays which contain and especially the third spinous, smooth ray in the dorsal fin are very similar to those in the extant xenocyprinines.

The caudal centra are well preserved and they are 19. Since the first few abdominal centra are usually badly crashed there are only 19 better preserved ones can be counted at most. It is estimated that there must be 3–4 centra more in front of

them. The total number of the vertebrae might be around 41－42. This also falls in the range of the number of the extant xenocyprinines.

The structure of the caudal skeleton agrees with that of most cyprinids, i.e. the first preural (PU_1) and the first and second ural centra (U_1, U_2) are fused to form a compound centrum. Fused with this compound centrum are the urostyl (US) extending posterodorsally, and the second hypural (H_2). The first hypural (H_1) and parhypural (PH) are articulated to that centrum but not fused to it. The rest of the hypurals (H_{3-6}) are attached to the posteroventral side of the urostyl. The compound centrum carries a short, incomplete neural spine (NS) on its dorsal side. There is a slender epural (EP) in front of the urostyl. No urodermal has been observed.

Comparison

Eoxenocypris liui shares with the extant and fossil xenocyprinines quite a few characters such as compressed pharyngeal teeth with extensive lateral surface and narrow grinding surface with point but not recurved tip, six teeth in main row; dorsal fin rays iii, 7, third unbranched of which spinous, not serrated; anal fin rays iii, 12, pectoral fin rays i, 15, pelvic fin rays i, 8; origin of dorsal fin opposite to insertion of pelvic, pectoral fin not reaching pelvic, insertion of pelvic at midpoint between origin of pectoral and anal. All these characters agree with those of xenocyprinines and there is no problem to refer the new form to the subfamily Xenocyprininae. Yet it differs from the known members of the subfamily including *X. yüshensis* by a few obvious distinctions: relatively small size, length of head exceeding depth of body, snout blunt, mouth terminal, opercular longer than deep, origin of dorsal fin closer to caudal fin base than to tip of snout, origin of anal fin closer to insertion of pelvic than to base of caudal. Consequently, owing to the characteristics of the new form it is difficult to refer it to any of the existing genera of the subfamily. So a new genus *Eoxenocypris* has to be created for it. Apart from pharyngeal teeth the xenocyprinine material from Japan also contains well preserved specimens. Yet no new taxon has been established for them so far. It can be recognized from the descriptions and illustrations that they share with *Eoxenocypris liui* certain characters, e.g. the fish identified as *Xenocypris* cf. *yüshensis* from Iki Island shows a terminal mouth. The material from Gifu Prefecture exhibits a similar state. For lacking of more detailed data, however, it is difficult to discuss about the relationship between them.

The two new species of a new genus of Xenocyprininae, i. e. *Xenocyprioides parvulus* and *X. carinatus*, established by one of us (Chen) based on materials collected from Guangxi Province show apparent differences from other extant members of the subfamily. Though the position of their mouth is similar to that in *E. liui* the very small size of their body with a standard length from 21 to 30 mm, the

absence of a stout unbranched ray in the dorsal fin, the much less number of the vertebrae (33–35) and scale rows in the flank (31–33) and the absence of a lateral line make them differ from all other extant xenocyprinines. Either their affiliation to Xenocyprininae broadens the scope of the subfamily or their phylogenetic position should be reconsidered together with the value of the subfamily.

Succession of Late Cenozoic fresh water fish faunas of East Asia and distribution of xenocyprinins in time and space

There are two main Late Cenozoic fish faunas within China as known so far. One is from the diatomite deposits of the Shanwang Formation (late Early Miocene) of Shanwang, Linqu, Shandong Province. The other is from the Mahui Formation (Late Miocene) and the Gaozhuang Formation (Early Pliocene) of Yushe, Shanxi Province.

The fish fauna from Shandong was described by Young and Tchang as containing forms all referred to the extant genera of the family Cyprinidae. A recent study of newly collected material from that locality by Zhou shows that with very few doubtful exceptions most of the fishes therefrom should be assigned to extinct, fossil genera. Though no xenocyprinines have been found from Shanwang Formation, their pharyngeal teeth were discovered from the Xiacaowan Formation (slightly earlier in age than the Shanwang Formation) of Sihong, Jiangsu Province. The Shanwang fish fauna is quite similar to the fish fauna discovered from a series of Early Miocene localities of Honshu and Hokkaido, Japan along the coast of the Sea of Japan, e.g. Kyoto, Fukui, Gifu, Ishikawa, Yamagata, southern part of Hokkaido etc. Some of the fossil forms even belong to the same genera, e.g. *Lucyprinus* was discovered from Shanwang, Gifu, Fukui, Ishikawa, Hokkaido and other localities. The Early Miocene fishes of eastern China and Japan seem to belong to the same fresh water fish fauna. Though also mainly consists of cyprinids as does the recent fresh water fish fauna of East Asia, this fauna is rather different from the latter in having most of its members belonging to extinct but not extant genera, not speaking of extant species. Cyprinins and leuciscinines are the dominant components of the fauna and xenocyprinines are very commonly met in the fish fauna of Japan. Japanese researchers have mentioned that the Early Miocene fresh water fish fauna of Japan is similar to the recent fish fauna of the East Asia continent but different from the recent fish fauna of Japan. Recent discoveries of the Early Miocene mammals in Japan corroborate the suggestion of the close biogeographical relationship based on fish. *Diatomys shantungensis*, used to be seen in the Shanwang Formation from Shandong and Xiacaowan Formation of Jiangsu, now is found in the Fukazuki Formation from Sasebo Basin, Nakasaki. *Youngofiber sinensis* from Xiacaowan Formation is also

found in the Toki Lignite Formation (corresponding to Nakamura Formation) from Kani Basin, Gifu.

The Pliocene Yushe fauna was studied by Liu and Su and the cyprinids from which were all referred to Recent genera or even Recent species such as *Cyprinus carpio*, *Carassius auratus*, *Mylopharyngodon piceus*, *Ctenopharyngodon idellus* etc. Only less than half of them were described as new species. Besides cyprinids the fauna includes *Parasilurus asotus* (recent species) of Siluriformes, *Siniperca wusiangensis* (fossil species of recent genus) of Perciformes and *Ophiocephalus argus* (recent species) of Ophiocephaliformes. The cyprinid composition of this fauna agrees with that of the contemporaneous fish fauna from the Iga Formation of Paleobiwa Lake, Japan on the subfamily level. They share members from the subfamilies Cyprininae, Xenocyprininae, Cultrinae, Gobioninae, Leuciscinae etc. Unfortunately, the Japanese material from Paleobiwa mostly consists of pharyngeal teeth, scales and disarticulated bones. It is difficult to make further comparison between the forms of the two areas. Besides cyprinids the Japanese fauna also contains *Parasilurus* and remains of Bagridae. The Japanese researchers studying the Paleobiwa fishes often compare them with the fish fauna from Yushe. The comparable composition of the two local faunas indicates that the eastern part of the Asian continent and Japan belonged to the same fresh water fish fauna during the Pliocene. This fauna contains several subfamilies of Cyprinidae. Almost all its components can be referred to extant genera and more than half of them are extant species. In addition to cyprinids there are also members of Siluriformes, Perciformes and Ophiocephaliformes. On the whole, the Pliocene fish fauna is rather similar to the Recent fresh water fish fauna from East China. Thus it can be suggested that the Recent fresh water fish fauna of this region was already formed in the Early Pliocene and continued to develop up to the present.

It should be mentioned that from the Early Miocene Chojabaru diatomite of Iki Island, apart from one form compared with *Xenocypris yushensis*, quite a few others were assigned to extant genera and species of Cyprinidae, e. g. *Cyprinus carpio*, *Achelognathus*, *Ancherythroculter*, *Hemiculter* etc. Even *Siniperca* was recognized from the material. If the identification is appropriate the composition of this fauna seems very different from that of the Early Miocene fish fauna from other localities of Japan but similar to the Pliocene fish fauna from Yushe. This fact has already been mentioned by Yasuno. There has been controversy about the age of the Chojabaru diatomite and the fossil material needs to be reviewed. No conclusion can be drawn about the nature and relationship of this fauna before either of these works done.

Xenocyprinines were among the common habitants of the Miocene fresh water of Japan. Most of them inhabited the lakes along the coast of the Sea of Japan. They survived in Japan until the middle of the Pleistocene, and then disappeared from that

area. Judging from these data and the only fossil xenocyprinine, i.e. *X. yüshensis*, known from China at that time was from Pliocene deposits, some Japanese ichthyologists inferred that the xenocyprinines were originated from the eastern margin of the Asian continent where the Japanese Islands now locate in the Early Miocene and then dispersed to the inland of the continent therefrom during the Middle and Late Miocene and continued to flourish here but became extinct in Japan. Plenty of remains of Miocene xenocyprinines discovered from the eastern part of China shows that the eastern part of China and Japan should have belonged to one and the same fish fauna in Miocene and Pliocene.

Conclusions

1. *Eoxenocypris liui* from the Miocene Daotaiqiao Formation of Hua'nan, Heilongjiang Province is a new genus and species different from all known extant and fossil xenocyprinines.

2. Xenocyprinines were already present in the eastern part of China during Miocene. The suggestion made by the Japanese ichthyologists that they were originated in the peripheral area of the Asian continent (Japanese Islands) in the Early Miocene then migrated to the inland of the continent is probably not the case.

3. Based on the study of Late Cenozoic fresh water fishes from eastern China and Japan the two areas most probably belonged to the same fish fauna in Miocene and Pliocene. This fauna continues to exist in China up to the present but in the Japanese Islands it has been replaced by the Recent local fauna since the middle of the Pleistocene.

4. The Miocene fish fauna from the eastern Asia consists mostly of extinct, fossil genera and species. In Early Pliocene the extant genera and species became dominant and continued to develop up to the present.

图版说明 (Explanations of plates)

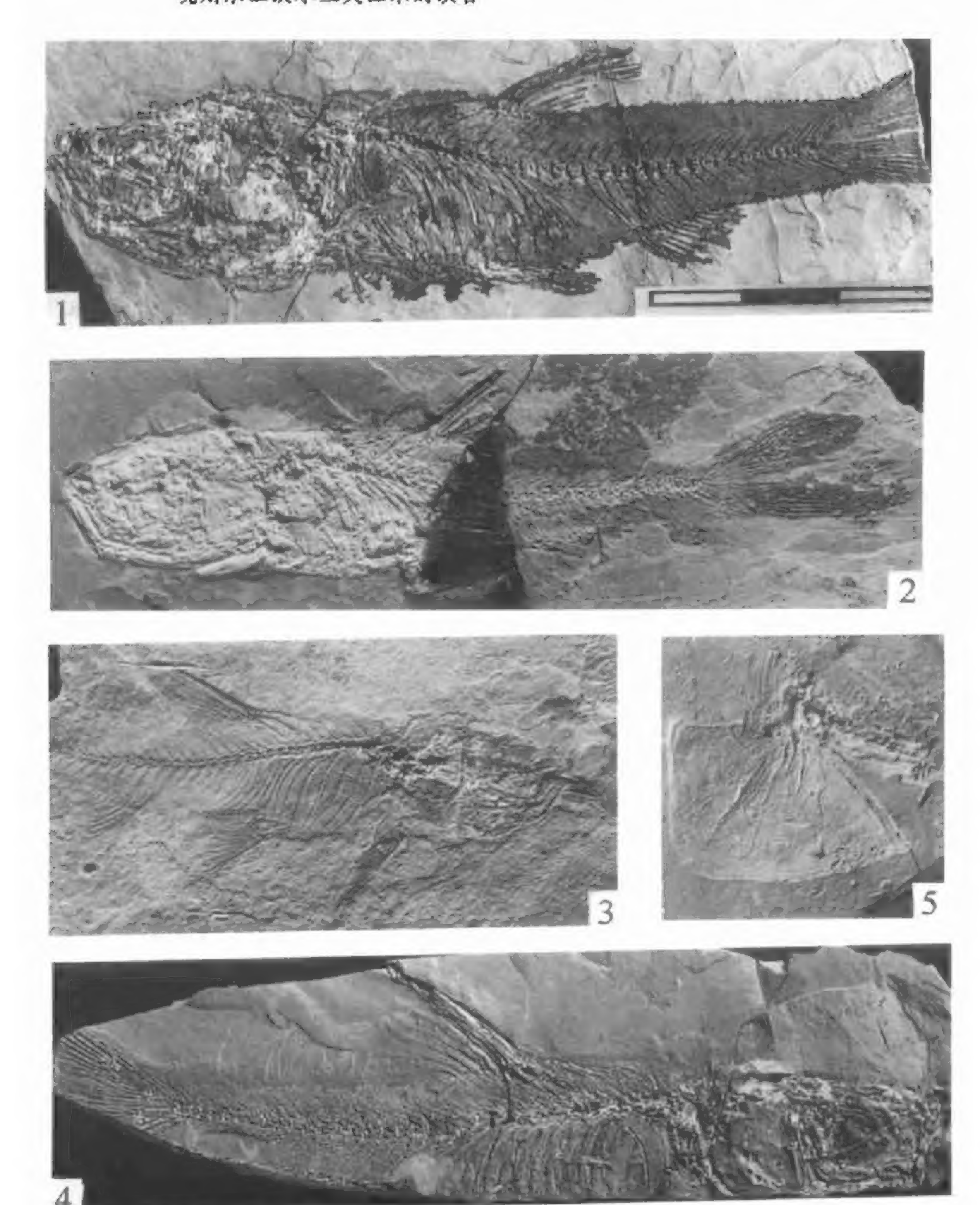
刘氏始鲴 *Eoxenocypris liui* gen. et sp. nov.

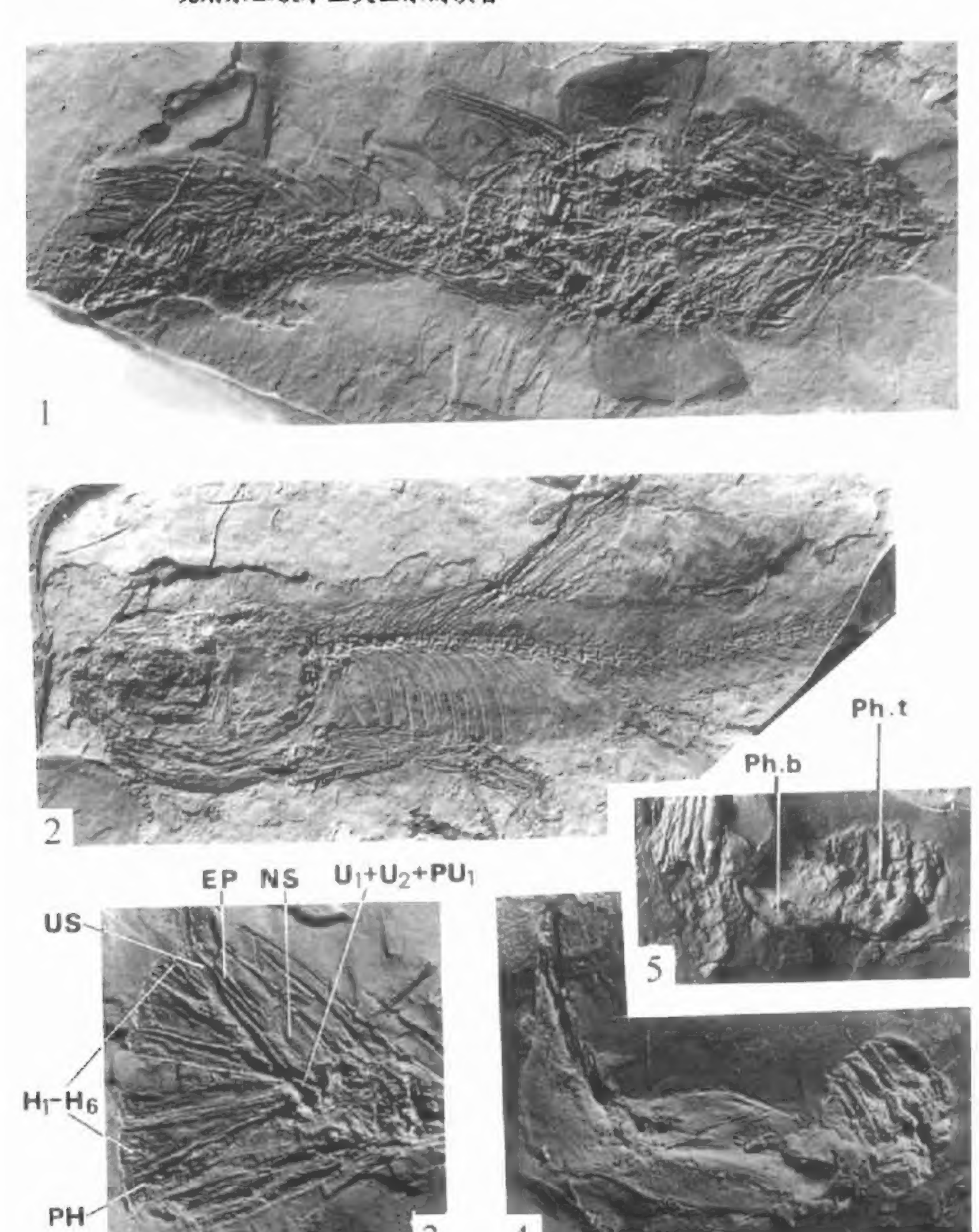
图版 I (Plate I)

1. V12064.1, 近于完整的鱼体; 左侧视; ×1.5 (Nearly complete fish; left side view)
2. V12064.8, 近于完整的鱼体; 左侧视; ×2 (Nearly complete fish; left side view)
3. V12064.7a, 近于完整的鱼体; 右侧视; ×1.5 (Nearly complete fish; right side view)
4. V12064.3a, 近于完整的鱼体; 右侧视; ×1.5 (Nearly complete fish; right side view)
5. V12064.11, 鳃盖骨; 外模; ×3 (Outer impression of left operculum)

图版 II (Plate II)

1. V12064.11, 近于完整的鱼体; 背视; ×4 (Anterior half of body, dorsal view)
2. V12064.2, 近于完整的鱼体; 左侧视; ×1.5 (Nearly complete fish; left side view)
3. V12064.12b, 尾骨骼; 右侧视; ×4 (Impression of left side of caudal skeleton)
4. V12064.18a, 匙骨及咽齿; ×4 (Ceithrum and pharyngeal teeth)
5. V12064.16a, 下咽骨及咽齿; ×4 (Pharyngeal bone with teeth); Ph. b. 下咽骨, Ph. t. 咽齿


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2
3
5
4


1
2
Ph.t
Ph.b
5
EP
NS
U1+U2+PU1
US
H1-H6
PH
3
4